Study of Translation of EST During the Last Thirty Years in China Based on Visualization

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Abstract

Based on the research data of the academic literature database of China National Knowledge Network (CNKI), the references of scientific translation in the past 30 years were retrieved. Based on the search results, pieces of literature with high citation frequency were selected as research data sources. With the support of visualization software and traditional metrology, the research analyzes the Chinese translation study of science and technology from the aspects of research power, hotspot and frontier. The research shows that the focus of scientific translation research is mainly on the perspective of language and linguistics, and there are few breakthrough translation research achievements. The problem of research is combining science and technology translation with frontier technology less. Based on this, it is suggested to accelerate the in-depth research in frontier areas, the new technology, new theory with scientific translation, and accelerate the training of scientific translation talents.

Keywords

Scientific and technological translation; Research variable analysis; Current situation; Revelation.

1. Introduction

With the reform and opening-up and prosperous economic and social development, the increase of scientific and technological innovative development, the development of science and technology has entered a new era, and the development of foreign exchanges and economic globalization has also entered a new era, providing a good opportunity and environment for the development of scientific and technological translation studies. In the past half-century, the translation of science and technology has experienced a leap-forward development from "exploration and pause" to "contention and development", and the translation of science and technology has gone from being ignored to attracting worldwide attention. "Domestic research on the translation of science and technology has also realized a deepening exploration from shallow to deep, but there are still some drawbacks" [2][3]. The number of theoretical and original papers in the field of scientific translation is relatively small. The review of historical research themes and research results provides new researchers with more specific research subjects and research themes. [4].

Using bibliometrics and visual analysis tools and methods, this paper analyzes and summarizes the current situation of scientific translation research in China in the past 30 years, taking authors, institutions, source journals, research hotspots, high-frequency keywords, and burst keywords as the main analysis parameters. It aims to explore the hot spot and frontier of scientific and technological translation research in the past 30 years.

2. Data Variable Analysis

Using the function of database visualization analysis of China National Knowledge Network and CiteSpace software, the research strength, hot spots, and frontiers of literature retrieval are analyzed.

2.1. Literature distribution

The number of literature can reflect the development status of the research field. The increase in the number means that more and more scholars pay attention to the research field and pay more attention to the research in this field. Among the retrieved data, more than 6,415 pieces of literature were retrieved from 1991 to 2021 with the theme of "Science and technology translation", including 3,456 literature from academic journals and 2,197 dissertations. Using the visualization program CNKI, we conducted statistical analysis on the number of published documents over the years and obtained Figure 1. In the past three decades, the number of publications related to scientific translation has increased year by year and reached a peak in 2012, but the number of publications has decreased in the past two years. From the perspective of literature sources, the number of Peking University core journal literature is 992, and the CSSCI source is 338. Accounting for 38.48% of the total search results. It can be seen that Chinese scholars have a strong interest in scientific and technological translation research, and the results of willow are rich and excellent in quality.
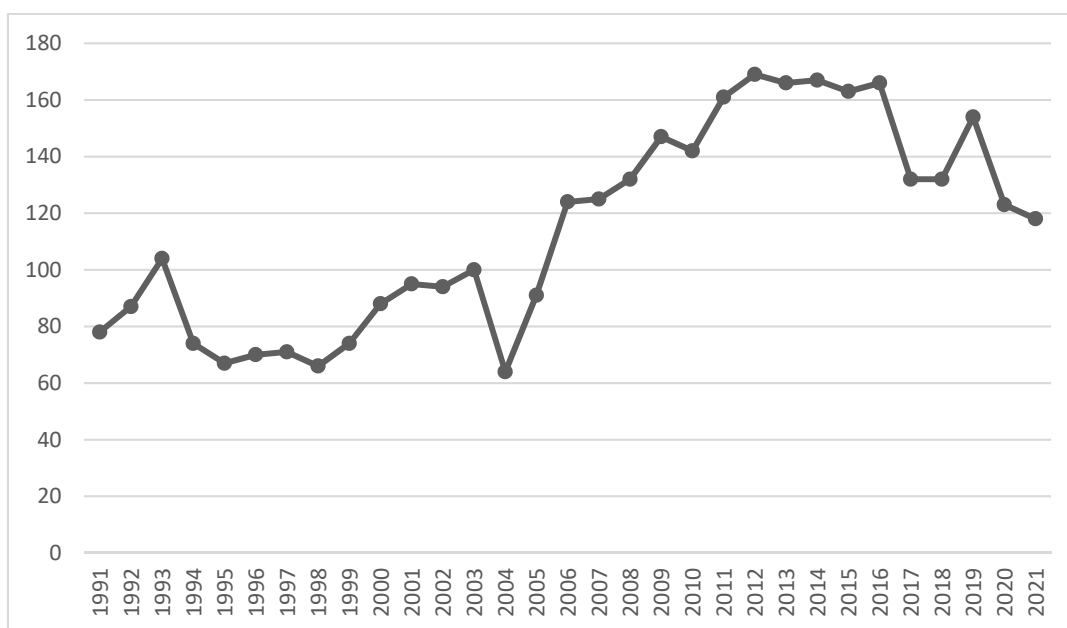
Figure 1. The trend of publications related to science and technology translation from 1991 to 2021

2.2. Literature Analysis

"The citation frequency of a document is directly proportional to its value and recognition. And the higher citation frequency indicates a greater value. In addition, it is also an intuitive manifestation of the recognition and recognition of scholars in this discipline "[4]. According to the research topic, the author set the retrieval time range from 1991 to 1999 and from 2016 to 2021. The literature was sorted according to the citation frequency, and the top ten papers with citation frequency were selected for analysis. According to the data, the pieces of literature with high citation rates in the past five years mainly include high-frequency keywords such as scientific English, scientific translation, translation methods, and professionalism. The top 10 cited pieces of literature were published from 2016 to 2018. Among the ten highly cited pieces

of literature, 60% were from the core journals of translation disciplines. Compared with the pieces of literature with high citation rates in the past five years, the keywords of pieces of literature from 1991 to 1999 mainly focused on "translation theory", "scientific translation", "EST", "translation activities", "translation standards", etc. Among the works of literature, the core journals of translation also accounted for 60%. Therefore, there is a positive correlation between high-quality literature and citation frequency of literature. In addition, according to the development of disciplines and research progress, the research theme and core will also change in different periods. The research results of highly cited authors also reflect the research core of this discipline.

In the past five years, the most cited literature is a *Review of Science and Technology Translation Studies in China (1997-2014)*, published in the *Chinese Science and Technology Translators Journal* in 2016: *Based on the consideration of 557 thesis statements*. In this paper, master and doctoral papers related to a scientific translation published in the CNKI database from 1997 to 2014 are used as research data to conduct objective qualitative and quantitative research, analyze cited existing problems, and propose corresponding countermeasures. At the same time, it reflects the current research status of domestic young and middle-aged scholars in scientific and technological translation and proposes improvement strategies based on bibliometric statistics and induction of the four modernizations, to explore a sustainable development path in the field of domestic scientific and technological translation [2]. Moreover, this paper reflects the current research status, problems, and countermeasures of translation majors in the field of scientific and technological translation studies, and provides a concise research framework and problems that should be paid attention to by subsequent researchers.

From 1991 to 1999, the most frequently cited article was Professor Fang Mengzhi's paper, titled *Translation of Science and Technology: The Coexistence of Science and Art*, published in the *Shanghai Journal of Translators* in 1999, which pointed out that contemporary humanities research increasingly relies on the methods and principles of natural sciences. Natural science produces data and interpretations of their meaning in its course, but scientists are far from grasping all of their meaning. To master them is to rely on the wisdom of all kinds outside the scientific community, including poets, philosophers, sociologists, historians, artists, musicians, and so on. Since the 1980s and 1990s, many foreign works have studied art and science, believing that the 21st century will be a century of further integration of natural science and humanities. Finally, it puts forward a clear viewpoint that the debate between science and art in translation will lose more and more realistic significance [5]. In a word, the scientific translation of this article is not only a simple text conversion in the field of natural science, but also needs to add the connotation of the field of humanities to make the article more spiritual. At the same time, the relationship between natural science and humanities should be introduced to put forward new ideas, new thinking, and new directions for scientific translation research, which is of great significance.

In addition, most of the highly cited papers were from the core journals of the translation major, such as *Chinese Science and Technology Translators Journal, Chinese Translators Journal, Shanghai Journal of Translators*, etc. This indicates that high-quality academic journals have a high influence on the professional field. Therefore, articles from such academic journals are cited relatively frequently, and scholars are also committed to displaying their research results through high-quality academic journals to promote professional development.

3. Research Hotspots and Frontiers

3.1. Analysis of research hotspots

CiteSpace displays high-frequency keywords in a certain field of research and the co-occurrence relationship between keywords in a visual way, from which we can have an intuitive

and clear understanding of hot research issues in this field, thus contributing to the adjustment and determination of research directions in the later period [6]. The circular pattern in Figure 3 is the keyword node. The larger the pattern, the higher the frequency of the corresponding node. The size of the font size of each node is the same as the reaction frequency, and the lines between nodes represent the co-occurrence relationship between keywords. From the map of high-frequency keywords in the figure, it can be seen that the most frequent occurrences are "scientific English", "translation", "translation strategies", "translation skills", "translation methods", "scientific terms", "Skopos theory", etc. It can be seen that Chinese scientific translation studies mainly take scientific English literary style as the research carrier, take translation strategies, translation methods, translation skills, and terminology as the main research objects, and support appropriate translation theories. The research also focuses on the micro perspective of language.

Figure 2. High-frequency Keywords (1991-2021)

Word frequency analysis is a method to extract keywords or subject words that can express the core of literature content from literature information and study the development trend and research hotspots of this field based on the frequency distribution [7]. Based on the graph of word frequency analysis, it can be seen that "scientific English", "scientific terms" and "translation strategies" are all hot topics in "scientific translation studies". According to the results generated by CiteSpace, keywords with centrality ≥0.10 are sorted and statistically analyzed, and Table 3 is obtained. Since centrality is a manifestation of the ability of keywords to act as media in the whole network, the higher the centrality, the more information flow between keywords is controlled. According to Table 1, core keywords and high-frequency keywords are the same, which overall reflect the important fields and main research directions of scientific translation studies. The main directions of Chinese scientific and technological translation studies are still scientific translation, translation theory, translation skills, and translation strategies. However, the starting time of these research directions was concentrated on about 20 years ago, and the time is far away. The research direction should also be combined with other disciplines, such as corpora, natural language processing, etc.

Table 1. Keywords of high school psychology

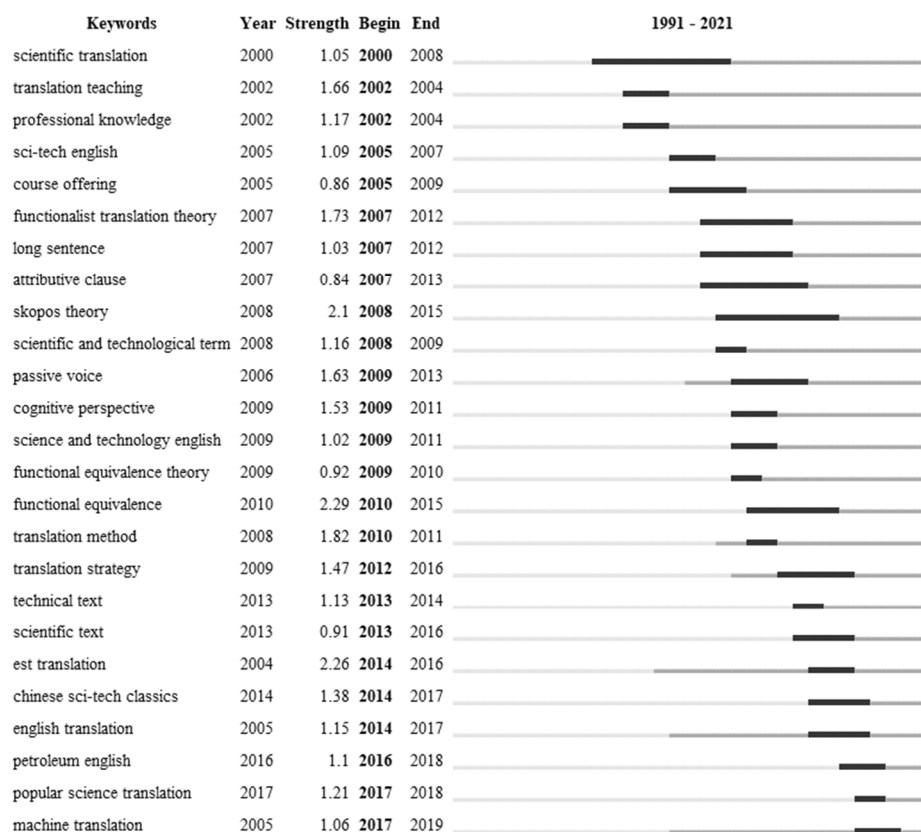| Count	Centrality	Year	Keywords
107	0.52	1991	Scientific and technological translation
155	0.45	1991	Scientific English
114	0.23	1995	translation
30	0.15	1991	Translation skills
17	0.15	2000	Technical terms
4	0.14	1991	Scientific and technological writing
4	0.13	1992	Translation theory
14	0.10	1991	Translation method

The keywords represent the core content of the article. In a specific period, if a keyword appears repeatedly in the literature of a certain field, it can be regarded as a research hotspot in this period [8]. Based on the common parameters, the keywords in two different periods from 1991 to 1999 and 2012 to 2021 are selected for comparative analysis. Among them, the common high-frequency keywords are "scientific English", "translation", "scientific translation" and so on. However, compared with the data from 1991 to 1999, the new keywords in the last nine years mainly include "machine translation", "term database", "term translation" and so on. As can be seen from the newly emerged keywords, with the development of science and technology and society, translation studies will also incorporate new content according to the time, so that the research will not fall behind The Times and science. As can be seen from Figure 4, the study of scientific and technological translation has been gradually refined into various small fields, such as "transcribed documents", "petroleum English" and "post-translation editing". It can be seen that although the research focus of scientific translation studies is still scientific English, translation strategies, translation methods, translation skills, etc., with the rapid development of many disciplines in recent years, the research keywords are gradually increasing, such as "machine translation", "post-translation editing", "glossary" and so on. Translation theories of scientific and technological translation studies, such as "communicative translation" and "functional equivalence", are also increasing. In short, the research hotspots of S&T translation studies have been increasing with the development of the discipline, but they are all micro-research hotspots. As for the cultivation of scientific and technological translation talents, there are few related contents on the integration of emerging technologies and scientific and technological translation.

3.2. Research frontier analysis

Based on the analysis of abrupt change terms in CiteSpace, the research frontier and development trend of this discipline can be explored. Among them, the frequency of use of abrupt terms increases significantly suddenly, or the terms appear suddenly in a short time [6]. Based on the CiteSpace analysis results, the top 25 reference mutation data were obtained (Figure 3). From 1991 to 1999, "translation activities" and "translators" were the keywords with the greatest mutation intensity. During this period, studies on "translation activities" mainly focused on the philosophical essence, social operation, social attribute, scientific translation activities, and scientific translation activities [9][10]. The research on "translators" mainly focuses on the aesthetic consciousness and aesthetic cultivation of translators, as well as the professional knowledge of translators. Compared with the previous decade, "syntax", "writing" and "vocabulary" had the highest intensity of mutation keywords from 2000 to 2010. It can be seen that the content of scientific translation research is more specific and detailed. In the past ten years, the keywords with strong mutation intensity are "scientific text", "popular science translation", "Belt and Road", "patent literature" and so on. Among them, the research

of "scientific text" as the keyword mainly includes the composition of scientific text, the machine translation of the scientific text, the corpus of scientific text, the translation of scientific text under the guidance of theory, and the translation strategy. As for "popular science translation", it mainly focuses on the accuracy, literariness, translation norms, body analysis, scientificity, and translator subjectivity of popular science translation. Translation of patent literature mainly focuses on translation norms and characteristics. The research of "One Belt and One Road" as the key words mainly focuses on the translation of scientific and technological classics into English, which promotes the scientific and technological classics to better serve the construction of Chinese cultural soft power [15]. To sum up, the translation of popular science and scientific classics is expected to become a new research frontier. In the current era of Chinese culture going out, scientific and technological classics are also a part of Chinese culture, and the translation of scientific and technological classics into English is naturally a part of Chinese culture going out. At the same time, in the new era, the construction of world power in science and technology and the realization of high-level science and technology self-reliance have put forward higher requirements for popular science work, and popular science translation has become more and more important.

Top 25 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	1991 - 2021
scientific translation	2000	1.05	2000	2008	
translation teaching	2002	1.66	2002	2004	
professional knowledge	2002	1.17	2002	2004	
sci-tech english	2005	1.09	2005	2007	
course offering	2005	0.86	2005	2009	
functionalist translation theory	2007	1.73	2007	2012	
long sentence	2007	1.03	2007	2012	
attributive clause	2007	0.84	2007	2013	
skopos theory	2008	2.1	2008	2015	
scientific and technological term	2008	1.16	2008	2009	
passive voice	2006	1.63	2009	2013	
cognitive perspective	2009	1.53	2009	2011	
science and technology english	2009	1.02	2009	2011	
functional equivalence theory	2009	0.92	2009	2010	
functional equivalence	2010	2.29	2010	2015	
translation method	2008	1.82	2010	2011	
translation strategy	2009	1.47	2012	2016	
technical text	2013	1.13	2013	2014	
scientific text	2013	0.91	2013	2016	
est translation	2004	2.26	2014	2016	
chinese sci-tech classics	2014	1.38	2014	2017	
english translation	2005	1.15	2014	2017	
petroleum english	2016	1.1	2016	2018	
popular science translation	2017	1.21	2017	2018	
machine translation	2005	1.06	2017	2019	

Figure 3. The strongest Citation Bursts

4. Current Situation and Enlightenment

4.1. Research Status

With the implementation of a science and technology innovation strategy and the progress and development of science and technology, high-quality science and technology translation research is not only conducive to the introduction of western advanced scientific and technological achievements and ideology and culture but also conducive to promoting local science and technology to the world. Based on the CiteSpace visual analysis tool, it is found that although there are many achievements in scientific translation research in the past 30 years, most of them focus on the micro level of scientific translation such as translation strategies, vocabulary, and syntax. In addition, despite the emergence of secondary translation studies in the field of scientific and technological translation studies, it still cannot get rid of the shackles based on the theoretical framework of translation and language micro-studies. In addition, although there are some hot research topics such as "machine translation", "post-translation editing" and "corpus", the research centrality is weak. Therefore, the research believes that more research should be done on the integration of new research hotspots and scientific translation, such as the establishment of translation tools based on machine translation research, the quality assessment of scientific translation machine translation, the standardization research of scientific translation from the perspective of corpus transliteration, and the training of scientific translation talents, to deepen the connotation and significance of domestic scientific translation research.

4.2. Research Enlightenment

From the perspective of ontology, scientific translation studies have always been centered on the topics of "scientific English" and "translation", and the research objects and perspectives are mainly "translation strategies" and "translation methods". These studies are based on the framework of translation theories to study language conversion. At the same time, driven by technology, new research directions and perspectives have emerged, such as "machine translation", "post-translation editing", "corpus translation" and other technical translation studies combined with technical studies. Therefore, the research object of scientific translation should shift from the perspective of words, sentences, and texts to the technical research of corpus translation, translation norms, translation techniques, and scientific translation. To enrich the scientific and technological translation research results and deepen the connotation of scientific and technological translation.

From the perspective of epistemology, the development of the study of the translation of science and technology not only reflects the course and trend of the study of English for science and technology from the perspective of linguistics but also reflects the progress of the country in the field of science and technology. In addition, the concretization of the research field is not only the study of language but also the epitome of the development and research of science and technology. The translation is involved in agriculture, industry, innovation and development, and advanced and sophisticated technology, which is not only an in-depth study of the language but also an understanding of the national development strategy and key areas.

From the perspective of methodology, the research methods of scientific translation studies in China are also constantly innovating. The center of scientific and technological translation studies is translation studies, which take language and text as research objects and translation theory as the research basis and adopt the research method of "theory + text". With the progress of technology, auxiliary tools for translation research have gradually increased, such as "machine translation", "corpus", "visual tools" and "statistical tools". With the help of scientific and technological tools, the research results tend to be scientific and objective. To enrich the achievements of scientific translation research and make the research more

profound, scientific translation research should rely on various tools to carry out objective and scientific research.

5. Conclusion

Based on the analysis of research data, it is found that the centrality of a language level in domestic scientific translation studies keeps high. Although there are many research achievements, few of them have high international influence. Therefore, the research suggestions should rely on the support of national policies and strategies, accelerate the in-depth research on hot topics and new technologies, promote the diversification of translation research results, and accelerate the strategic pace of spreading Chinese culture worldwide. In addition, scientific translation research should be combined with new technology and a new theoretical basis to promote scientific translation research to the macro field and deepen the connotation of scientific translation research. And it is necessary to accelerate the training translators of scientific and technological translation, innovate the training programs, and promote scientific and technological translation research in China to a new milestone.

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